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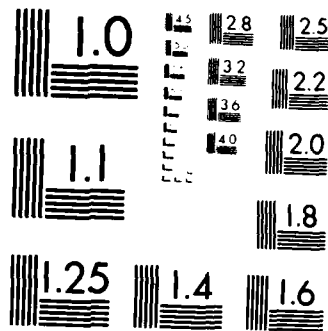
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Figure 10



MICROCOPY RESOLUTION TEST CHART
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Thomas A. Brown

February 1984

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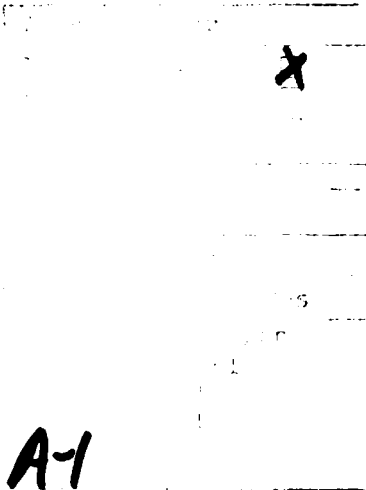
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POTENTIAL APPLICATIONS OF MANUAL GAMES

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INTRODUCTION

There is a lot of excitement in the air these days about very highly automated games and the use of artificial intelligence in gaming. I fear that in our enthusiasm for computers we may lose sight of some of the virtues of old-fashioned manual games. In this talk I would like to point out some of these virtues. I will also suggest some improvements in the way manual games are conducted which will, I believe, overcome many of the problems of manual games without compromising their virtues.

WHAT DO WE MEAN BY "MANUAL GAME"?

Not so long ago it was easy to distinguish a "manual game" from a "computer game." When computers were big, hard to program, and had awkward input/output, any game that made substantial use of a computer was dominated by the computer. Rapid advances in computer science have substantially changed this situation. Now we see micro-computers sneaking into gaming exercises which were previously entirely manual in character. I am not willing to call a game a "computer game" just because some electronic equipment is used to keep track of logistics, combat results, and force status. Even a highly computerized game like Livermore's "Janus II" feels like a manual game. In Janus II the positions of a player's forces are displayed on a cathode ray screen map, and many of the movement details and the conventional fires are

[1] This paper is the substance of a talk the author gave at the 1982 Joint National Meeting of the Operations Research Society of America and The Institute of Management Sciences on October 25, 1982.

calculated by the computer with no intervention by the player. But the game focuses on nuclear fires which are determined entirely by the two players and whose effects are displayed very transparently to the players. It took two or three years to bring Janus II to its present level of transparency and efficiency, and it represents a substantial amount of very sophisticated programming.

To take an example more close to home, you can buy a computer module for your Monopoly set which will role the dice, keep track of the money and property, and pass out the community chest and chance cards. But it seems to me that Monopoly is still a manual game, even if you are playing it with a computer module.

I would like to define a game as being a manual game, for purposes of this talk, as one that "plays like" a manual game. That is to say, if the player's role in the game is similar to the role which players have traditionally fulfilled in manual games. To be more specific, the game must meet the following two criteria:

- o The players must make decisions from one turn to the next about their tactics and strategy, taking into account (possibly) changing patterns of information about the status of forces on the two sides.
- o The procedures used to evaluate the consequences of the player's decisions must be quite clear to the players. This does not mean that the players know the status of the opponent's forces, but rather that they do know how the results of their actions will be calculated, given assumptions about force location and status.

The first criterion means that if one of the sides is being played by an automaton, or if the players specify a complete strategy at the beginning of the game and thereafter simply watch as the consequences of the strategy are worked out, the game would not fall within the category of games I will discuss today.

The second criterion means that the evaluation procedures must be simple enough so that the players are fully able to understand them. If the computer routines used in evaluating combat results are so complex that the players have no realistic chance of knowing which factors are taken into account and which are not, then the game might be manual in form but will not have some of the advantages I consider characteristic of manual games. Therefore I will restrict the balance of my discussion to games that meet the twin criteria of providing for interaction with live human players throughout the course of play and providing relative clarity of game procedures.

WHAT ARE MANUAL GAMES GOOD FOR?

There are four areas in which manual games, as I have defined them, have particular advantages over non-manual games:

- o Study of partially understood dynamic processes
- o Study of partially understood force interactions
- o Building players' backgrounds for future study and analysis
- o Continuous game improvement on the basis of players' criticism.

First, many of the problems we face in formulating force postures and doctrines for the future stem from the fact that war is a dynamic process. Forces move, become damaged, run out of supplies, and are

subject to numerous other changes as the conflict proceeds. Our picture of the battlefield, even if it is relatively clear at the start of hostility, becomes confused and polluted. It is very hard to sit in an armchair and visualize the results of making irreversible decisions under the conditions of incomplete and rapidly changing information which will exist in wartime. Setting up a wargame is a way of acting out this situation and attempting to reproduce the dynamics of the decisionmaking environment under these conditions. In setting up a wargame then, one must pay careful attention to communications, reconnaissance, command and control, and the actions which each side can take to confuse the other side. We all know that many wargames pay very little attention to command and control; this is a great pity because gaming is uniquely suited to increasing our understanding and appreciation for the information dimension of warfare.

During the second quarter of this calendar year I interviewed 21 defense officials (mostly in the Pentagon, but one or two in the CIA, the National War College, and the National Security Council staff) concerning the topics that they considered most important for study at this time, and the topics which they considered most appropriate for gaming. One of the topics which ranked near the top in importance was, "How will the increased importance of space affect the global balance?" However, this topic ranked near the bottom in appropriateness for gaming. I probed the respondents on this, and the main reason for the low rating appeared to be that none of the respondents had ever seen or participated in a game that treated space seriously. The current military applications of space all seem to deal with information:

- c Communications
- o Warning
- o Navigation
- o Weather
- o Reconnaissance.

If you accept the idea that wargaming is a good way of studying the impact of information in war, then it follows that it should be a good way to shed light on the impact of space on the global balance. I would like to see game designers work on this problem, so that we can begin to build some "artificial experience" on the role of space in wartime. This "artificial experience" could have a very important influence on the development of space doctrine over the years ahead. Some of the subissues that could be clarified are the following:

- o Terrestrial tactics to compensate for loss of space assets
- o The relative roles of survivability and reconstitutability for space systems
- o Requirements for anti-satellite systems.

Information in war is just one (although perhaps the most interesting one) of many dynamic processes that strongly affect combat but are difficult to analyze in a static environment. The problems of logistics and sustainability are one example. The problem of long-term survivability is another. All of these problems can be clarified by acting out the process in a suitably structured environment.

The second category of problems which offer unique opportunities for manual gaming are those relating to interactions among different

types of forces. Almost all nations divide their forces into Army, Navy, and Air Force, and the careers of individual officers are usually restricted to just one of these services. But in actual combat all services must act together toward common goals, and suitably designed wargames offer a good way of breaking down the intellectual barriers among the services. Even more serious than barriers among services are the psychological barriers between conventional, theater nuclear, and strategic nuclear forces. These psychological barriers have some of their roots in the fear of escalation. I do not want to be misunderstood as advocating more willingness to escalate to nuclear weapons, or reducing the fire-break between nuclear and conventional weapons. But realism compels us to recognize that each category of weapon has substantial potential effects on the other categories. The use of nuclear weapons will not make conventional forces simply disappear from the equation, and an extended period of conventional conflict might have great effects on the nuclear capabilities of the two sides. Years ago, it was thought that Soviet fear of escalation would protect our nuclear forces from conventional attack. But today nuclear parity has tended to equalize the fear of escalation, and the Soviet nuclear forces provide an umbrella which makes it less and less credible that we would immediately respond to conventional attacks on nuclear forces with a nuclear counterstroke.

This is by no means just a theoretical possibility. General Bernard W. Rogers recently announced that the Soviets had created special reinforced divisions (called "maneuvers divisions") whose objective was penetrating very quickly to the rear of NATO forces and putting NATO nuclear units out of action before they could be used.

These tactics have been tested in recent Warsaw Pact Baltic Sea maneuvers (reported in Defense Daily, October 15, 1982). In the survey of defense officials referred to above, the question, "Which side would do better in an extended nuclear/conventional war with the forces projected for 1990?" ranked near the top in terms of importance and at the very top in terms of appropriateness for gaming. One of the most important aspects of this question is the problem of the dynamics of escalation, and how the balance of forces shifts and the opportunities for action narrow or broaden as combat proceeds over time. It is very hard to think your way through this complex problem and decide on a course of action for every conceivable contingency. Manual gaming, in which the players may adapt continuously to the game situation as it evolves, provides a way to get into the problem and identify some of the issues which are likely to arise.

The third advantage of manual wargames is that they build the players' backgrounds for future study and analysis by other means. I have noticed, and I am sure others have, that those who actually participate in manual wargames will often praise the experience and say that they have learned a lot from their participation. However, it is very hard to convince someone who was not a participant of the validity of the lessons learned from a given exercise. When we played the Strategy and Force Evaluation games at The Rand Corporation in 1962, the final report barely mentioned the six plays of the games. The preparation of the final report was made much easier because the members of the study team had all participated in plays of the games: this gave them a basis of shared experience and a common vocabulary which enabled them to hammer out the lessons learned and express them in terms which

did not require direct reference to the games themselves. Now the advantages of this shared experience and common vocabulary will only be realized if the players are intimately involved in the play as it evolves and if the causal relationships among decisions, events, and outcomes are relatively clear to them. If the players make all their decisions at the beginning of the play and are passive spectators from then on, I do not believe that the learning and involvement will be as great as when they participate on a more continuous basis.

Another advantage to having the players involved very closely and on a continuous basis in the play of the game is that it creates a mechanism for improving the game itself. If you interview players (either separately or in a group) immediately after the game is over, they will often be able to make specific criticisms of game mechanics pointing out areas which have been inadequately modeled. This provides a form of close criticism which seems to be hard to get in the systems analysis business, and it should be systematically exploited to improve the quality of manual exercises. If the players are not closely involved in game mechanics, the quality and utility of their criticism is likely to be much lower.

WHAT ARE THE WEAKNESSES OF MANUAL GAMES?

Unfortunately, manual games suffer from some characteristic weaknesses and problems. I would like to discuss these weaknesses under four basic headings:

- o Irreproducible results
- o Short shelf life

- o Manpower intensive (and therefore expensive)
- o Error proneness.

The first problem with manual games is that the results of a given game are often difficult or impossible to reproduce. The game results are, after all, the product of numerous individual decisions made by the players and by the controllers, together with a certain number of random numbers. Often these decisions are not recorded in any systematic way, the random numbers drawn are not kept track of, and the controllers take numerous unrecorded shortcuts in calculating combat results. I have sometimes looked at the rooms and apparatus used in a manual wargame after the game is over and the players have gone home, and the scene has often been something like the following. The maps used by the players accurately reflect the position at the end of the game, but if you search for evidence of how this end position came about you find nothing but unsystematic notes and scribbings. The controllers' space will often have several sheets of calculations wadded up and resting on the floor with no indications (or only very sketchy ones) of what the calculations mean. You search in vain for any kind of log or turn-by-turn record of the events of the game. Often the best record of game events is only reconstructed after the game is over when the players and controllers get together for the hot washup. This state of affairs makes it hard to compare one play of a game with another, and also makes it hard to learn general lessons from a set of plays. The situation can be corrected in part by establishing standards of documentation and procedures that will ensure the keeping of records while the game is actually being played. But players and controllers are often reluctant

to adopt such procedures because they tend to slow down the pace of the game. The controllers in particular are usually anxious to evaluate the consequences of a given move as rapidly as possible so as to minimize the "dead time" to which the players are exposed. Furthermore, even if such procedures are followed meticulously, the game is still not "reproducible" in the sense that if you took the identical teams and identical initial conditions the game would not follow the identical course if you played it over (unless, of course, you scripted the decisions and random draws made the first time through and simply mimicked them).

The problem of short shelf life for manual games does not come primarily from the fact that weapons, tactics, and orders of battle change over time, but rather from the fact that most manual games include a number of procedures and assumptions which are never fully documented and only exist in the minds of the controllers and those experienced with this particular game. Even if a manual game has all its rules and procedures written down in full detail in manuals which are well-organized and clearly written, it is still much more difficult to learn to play a game from written instructions than it is to learn it from someone who already knows how to play. When you bring a new commercial game home from the toy store, it sometimes takes hours to master the written rules, but thereafter new players can be taught the game in just a few minutes. The same is true of manual war games. Once a wargame is put on the shelf, players and controllers begin to forget how to play it. After a few months or a year at most, it may become almost easier to create a new game than to re-establish the old one. This problem can be coped with by partial automation of game procedures

(since computer programs have better shelf life than manual procedures) or by creating an environment in which manual games are exercised on a relatively continuous basis, so that the better manual games are never put on the shelf at all. This latter course is followed to some extent by the service war colleges; whether it is practical for a private contractor is somewhat uncertain in view of the relatively short-term nature of most study contracts.

Manual wargames are notoriously manpower-intensive, and this usually means they cost a lot to run. Modest computer assistance may help smaller control teams manage fairly elaborate games, and careful game design may be used to minimize the size of player teams, but there is no denying that each hour of play represents many man-hours of effort. However, most major study projects involve a reasonable number of team meetings, seminars, and briefings; these are also "manpower-intensive activities." I believe that, in many cases, a well-designed manual wargame can bring a study team more efficiently to grips with the problem it is addressing than a round-table discussion or seminar. While a manual wargame is certainly more expensive than a lone individual reading up on a problem, it is not more expensive than many group activities which are an accepted part of most major studies.

The final problem which manual wargames face is that manual control procedures are prone to error. As mentioned before, controllers are driven to take shortcuts in their eagerness to avoid dead time, and the lack of documentation which is so common means that there is no audit trail whatsoever. The only audit is whether the results "seem right" to the players. It is clear that under these circumstances a wargame can turn into a kind of positive feedback loop which amplifies conventional

wisdom to the point of absurdity. The problem of errors in operating manual games is very similar to the problem of reproducibility, and the same measures which reduce the problem of reproducibility will reduce the problem of exercise errors. A format for documentation of the controllers' calculations will produce an audit trail, and a certain degree of automation will also tend to reduce errors. Naturally, whenever you introduce automation into a manual game, you run some risk of distancing the players from the game procedures and sacrificing the unique advantages of manual games. Avoiding this pitfall is a challenge to the art of the game designer.

CONCLUSIONS

I believe that manual games, in the sense of games in which human players make move-to-move decisions in an environment which makes the consequences of these decisions ultimately fairly clear to the players, have an important role to play in the analysis of dynamic decision processes. This is especially true if the decision process is one which is important, but which does not take place frequently enough for a body of reliable real world experience to be built up. War between the great powers is an example of such a decision process.

However, in order for manual games in the defense area to be in maximum use, there are three measures which I feel should be taken:

- o Higher standards of documentation should be instituted in manual gaming exercises.
- o Automation should be introduced into the control function without eroding the involvement of players in the game.

- o Manual games should be institutionalized so that good games are kept alive. Whether this should be done by war colleges welcoming guest players, or by some special arrangement with a defense contractor, or by some other arrangement is a subject for further study. But the expensive and unproductive cycle of game creation, application, and decay ought to be broken.

If these steps are taken, I think that manual gaming will be even more widely accepted as a legitimate study activity.

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